2014 Annual Report on Air Emissions from Facilities at Campbell Industrial Park

Prepared by:
Clean Air Branch
Hawaii State Department of Health

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Introduction

This report has been prepared by the Clean Air Branch of the Department of Health pursuant to the requirements set forth in Hawaii Revised Statutes (HRS) section 342B-18. The purpose of the report is to provide members of the communities surrounding Campbell Industrial Park and Kahe Valley with an understanding of the circumstances and activities related to ambient air quality in those areas.

HRS 342B-18 directs the Department of Health to generate an annual report to the communities using specific information provided by the major sources located in Campbell Industrial Park and Kahe Valley. The information for this report is based on the annual data collected in 2013.

For the sake of clarity, the report is divided into three sections. Section one addresses the activities of the major sources and is split into two distinct parts. The first part of section one describes each major facility, the sources of emissions, and the air pollution controls that the facility employs to minimize its air emissions. The second part, Table A, identifies the type and quantity of criteria air pollutant emitted by each major facility for the calendar year.

Section two provides the air quality monitoring data obtained from the three monitoring stations located on the outskirts of Campbell Industrial Park. The data are presented in tabular form as well as in graphs which compare the data to the federal and state ambient air quality standards. In every case, Hawaii's air quality is far better than the national, health-based standards. The graphs also help illustrate any trend over the last five years.

The final section is a report on the measurements of the criteria and non-criteria air pollutants and the expected health effects at the measured levels. The purpose of this section is to provide the reader with an understanding of the potential impacts on human health at the existing levels of air quality.

The Clean Air Branch of the Department of Health administers the statewide air pollution control program. It consists of a permitting program which regulates the facilities, an air quality and source monitoring program, and an investigatory and enforcement program.

If you have questions about this report or about air quality, please contact the Clean Air Branch at the following:

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A copy of this report can be found at the Clean Air Branch website:
http://www.hawaii.gov/health/environmental/air/cab/index.html
Click on the link, "2014 Annual Report on Campbell Industrial Park."

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SECTION 1.
Summary of Criteria Pollutants Emitted by Major Source Facilities in Campbell Industrial Park & Kahe Valley in 2013 and a Description of the Air Pollutant Controls

Criteria Pollutants Emitted by the Facilities

The criteria pollutant emissions from the major sources in Campbell Industrial Park (CIP) and Kahe Valley are listed in **Table A**. The emissions were derived using actual operating hours or fuel usage, stack test results, continuous emission monitoring data, and standard emission factors.

Descriptions of the Respective Criteria Pollutant Controls

AES Hawaii Cogeneration Plant

AES Hawaii, Inc. operates a coal-fired cogeneration plant which generates electricity for operation and sale to Hawaiian Electric Company (HECO). Coal is imported, crushed, then fed into two (2) circulating fluidized bed (CFB) boilers. Tire derived fuel (TDF), spec used oil, wood, and spent activated carbon are permitted as secondary fuel. After combustion, the air emissions flow through a selective non-catalytic reduction system and baghouse before it reaches the exhaust stack. There is also a cooling tower which extracts heat from the combustion gases and emit particulates which are dissolved solids in the evaporated water.

Total suspended particulates (TSP), particulate matter which are 10 and 2.5 microns or smaller (PM_{10} and $PM_{2.5}$, respectively), sulfur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO), volatile organic compounds (VOC), and lead (Pb) are the primary air pollutants being emitted from this facility. The following briefly describes the air pollution control methods being employed. Fugitive TSP emissions are contained in enclosed structures during the transportation and processing of the coal. Baghouses also collect fugitive TSP emissions during the processing stage. During the combustion stage, a baghouse is also used to collect TSP and Pb. SO_2 is controlled by the use of limestone injection into the two (2) boilers and the use of coal fuel with a maximum sulfur content of 1.5% by weight. NO_x is controlled by the use of a selective non-catalytic reduction system for the boilers. The TSP, PM_{10} and $PM_{2.5}$ emissions from the cooling tower are controlled by limiting the water flow rate and amount of total dissolved solids within the water.

Chevron Refinery

Chevron operates a petroleum refinery which produces various types of petroleum products. Petroleum is imported by ship and stored in above ground tanks prior to processing. The petroleum is processed, or refined, to produce various petroleum products. The main emission units are storage tanks, furnaces, boilers, combustion turbines, cooling tower, and flares.

TSP, PM_{10}, $PM_{2.5}$, SO_2, NO_x, CO, and VOC are the primary air pollutants being emitted from this facility. The TSP, PM_{10} and $PM_{2.5}$ emissions are mainly controlled by a cyclone and electrostatic precipitator (ESP) for the FCC stack. The cooling tower also emits TSP, PM_{10} and $PM_{2.5}$ emissions which are controlled by limiting the water flow rate and amount of total dissolved solids within the water. A caustic scrubber reduces SO_2 emissions during flaring events from shutdowns or upsets. NO_x is controlled by the use of low NO_x burners in the furnaces and water injection/low NOx burners in the combustion turbines. CO and VOCs are controlled by the use of steam atomizers and excess oxygen which completes the combustion process before the exhaust is emitted through the exhaust stack. VOC is also controlled by the use of a flare, a Benzene Recovery Unit, and the employment of proper leak detection and maintenance procedures. During the storage of the petroleum products, VOC is controlled with the use of various equipment for petroleum storage tanks such as gaskets, seals, and floating roofs. Since calendar year 1998, secondary seals have been installed on all applicable hydrocarbon tanks to provide additional controls for VOC.

Hawaiian Electric Company (HECO) - Campbell Industrial Park

HECO operates a biodiesel fueled combustion turbine generating station in Campbell Industrial Park. The facility operates one (1) simple cycle combustion turbine generator and two (2) black start diesel engine generators. Biodiesel for the combustion turbine generator is imported and stored inside above ground storage tanks. The generating station is the first biodiesel fueled combustion turbine plant in Hawaii and represents a significant step toward reducing Hawaii's dependence on fossil fuels.

Primary air pollutants emitted from this facility are SO_2, TSP, PM_{10}, $PM_{2.5}$, NO_x, CO, and VOC. A water injection system is used to control NO_X from the combustion turbine generator. The system injects demineralized water into the turbine generator's combustion chamber to reduce peak flame combustion temperature. Lowering combustion temperature reduces the formation of thermal NO_X. Low sulfur fuel with not more than 0.05% by weight sulfur content is used to minimize SO_2 emissions from the combustion turbine generator. The black start diesel engine generators are fired on ultra low sulfur fuel with maximum 0.0015% by weight sulfur content. Good combustion practices are used for the combustion turbine generator to minimize particulate, CO, and VOC emissions. Storage tanks servicing the combustion turbine generator are equipped with internal floating roofs with tank seal systems to control VOC emissions.

Hawaiian Electric Company - Kahe Valley

HECO operates Kahe Generating Station in Kahe Valley. Fuel oil is received by pipeline from HECO's Barber's Point tank farm next to CIP Generating Station, then stored in above ground storage tanks at the Kahe facility. From the storage tanks, the fuel oil is fed into the six (6) boilers and two (2) black start diesel engine generators for combustion.

TSP, PM_{10}, $PM_{2.5}$, SO_2, NO_x, CO, VOC, and GHGs are the primary air pollutants. TSP, PM_{10}, and $PM_{2.5}$ are mainly controlled by the consumption of fuel oil with a low ash content. Periodic soot removal of the exhaust stacks also help control TSP, PM_{10}, and $PM_{2.5}$ emissions to minimize short-term concentrations. The SO_2 emissions are controlled by the combustion of low sulfur fuel oil (< 0.5% sulfur by weight). Thermal NO_x is reduced by lowering the initial combustion temperature of the boiler units. The combustion temperature is lowered by the use of a low NO_x burner in Boiler K6, flue gas recirculation, tangential firing, and low excess oxygen. The CO and VOC emissions are controlled by the use of steam atomizers and excess oxygen which completes the combustion process before the exhaust is emitted through the exhaust stack.

Honolulu Resource Recovery Venture (H-POWER)

H-POWER operates a municipal waste disposal facility to generate electricity for its operation and sale to HECO. The municipal waste is received, sorted, shredded, then fed into two (2) 854 ton per day refuse derived fuel (RDF) municipal waste combustor (MWC) boilers. A 900 ton per day mass-burn MWC boiler with associated air pollution controls and steam turbine is being constructed to increase plant capacity. Post combustion air pollution controls are used for the boilers to control pollutant emissions. Bottom ash and fly ash from the boilers is collected and disposed in a landfill. Cooling towers are also used to extract heat from boiler circulation water systems.

TSP, PM_{10}, $PM_{2.5}$, SO_2, NO_2, CO and acid gases are the primary air pollutants emitted from boilers at this facility. TSP, PM_{10}, $PM_{2.5}$ and MWC metals (cadmium, lead, and mercury) from boiler combustion are controlled with baghouses. Emissions of SO_2, sulfuric acid, hydrogen chloride, and hydrogen fluoride are controlled with spray dryer absorbers. The spray dryer absorbers inject a lime slurry which absorbs SO_2 and other acid gases. The baghouses then remove the lime slurry precipitate and other particulate from the boiler exhaust stream. Emissions control for the new mass-burn boiler will include selective non-catalytic reduction (SNCR) and very low-NO_X (VLN) systems to control NO_2 emissions. An activated carbon injection system will also be used for the mass-burn boiler to reduce mercury and MWC organics.

Controls are used for other sources that generate emissions at this facility. Particulate in ventilation air from inside the waste processing building is controlled with baghouses where shredders operate. Fugitive dust is controlled with enclosures and/or paved areas for waste processing, ash handling systems, and transportation. Particulate from dissolved solids in drift droplets that leave the cooling towers is controlled with drift eliminators.

Kalaeloa Partners Cogeneration Plant

Kalaeloa Partners operates a cogeneration plant which generates electricity for its own use and for sale to Hawaiian Electric Company. This facility qualifies as a cogenerator since it also produces steam with the hot combustion gases. The steam is sold to Tesoro.* Fuel oil is piped in from Tesoro and consumed by two combustion turbines. There is also a cooling tower which extracts heat from the combustion gases and emits particulates which are dissolved solids in the evaporated water.

TSP, PM_{10}, $PM_{2.5}$, SO_2, and NO_x are the primary air pollutants being emitted from this facility. The following briefly describes the air pollution control methods being employed. SO_2 is controlled by the use of low sulfur fuel oil (< 0.5% sulfur by weight). NO_x is controlled by the use of steam injection which lowers the combustion temperature. The cooling tower TSP and particulate matter emissions are controlled by limiting the water flow rate and amount of total dissolved solids within the water.

Hawaii Independent Energy, LLC (HIE)

Hawaii Independent Energy, formerly known as Tesoro Hawaii, operates a petroleum refinery producing various types of petroleum products. Petroleum is imported by ship and stored in above ground tanks prior to processing. The petroleum is processed, or refined to produce various petroleum products. The main emission units are storage tanks, furnaces, boilers, a combustion turbine, cooling tower, and a flare.

TSP, PM_{10}, $PM_{2.5}$, SO_2, NO_x, CO, and VOC are the primary air pollutants being emitted from this facility. The following briefly describes the air pollution control methods being employed. The TSP, PM_{10} and $PM_{2.5}$ emissions are mainly controlled by the consumption of fuel oil with a low ash content. The cooling tower TSP, PM_{10} and $PM_{2.5}$ emissions are controlled by limiting the water flow rate and amount of total dissolved solids within the water. SO_2 is controlled by the use of low sulfur fuel oil (< 0.5% sulfur by weight) and process controls such as a sulfur recovery unit. The sulfur recovery unit removes the sulfur from the gas streams which is condensed and sold as a solid. NO_x is controlled by the use of low NO_x burners in the heaters and water injection in the combustion turbine. VOC is controlled by the use of a flare, a thermal oxidizer for wastewater treatment, and the employment of proper leak detection and maintenance procedures. During the storage of the petroleum products, VOC is controlled with the use of various equipment for petroleum storage tanks such as gaskets, seals, and floating roofs. Slotted guide poles with sleeves were installed in 28 storage tanks to reduce fugitive VOC emissions.

TABLE A
2013 Campbell Industrial Park and Kahe Valley Major Source Criteria Emissions (tons/year)

Facility	TSP	PM_{10}	$PM_{2.5}$	SO_2	NO_x	CO	VOC	Pb
AES [1]	169	141	106	1,505	627	55	4	0.00
Chevron [2]	92	79	62	648	690	98	1,807	0.20
HECO CIP Plant	2.3	2.3	2.3	0.4	35	109	1.8	0.00
HECO Kahe Plant	746	593	483	6,268	7,932	342	53	0.00
HPOWER [3]	122	105	92	1.4	862	61	4	0.00
Kalaeloa Partners	365	346	323	2,416	2,380	18	13	0.10
HIE [2]	23	20	18	140	536	169	481	0.01
TOTAL (tons/year)	1,519	1,286	1,086	10,979	13,062	852	2,364	0.31

Source: State Department of Health, Clean Air Branch November 2014. Based on Covered Source actual emissions as submitted by the respective sources.

TSP - Total Suspended Particulates
SO_2 - Sulfur Dioxide
NO_x - Nitrogen Oxides
CO - Carbon Monoxide
VOC - Volatile Organic Compounds
Pb - Lead
PM_{10} - Particulate Matter with aerodynamic diameter less than or equal to 10 microns
$PM_{2.5}$ - Particulate Matter with aerodynamic diameter less than or equal to 2.5 microns

Note:
1. The nitrogen and sulfur content in the coal supply will continue to vary year to year.
2. The emissions will vary year to year depending on the demand for fuel.
3. The emissions may differ year to year due to the inconsistency of fuel (municipal waste).

SECTION 2.
Ambient Air Quality at Campbell Industrial Park: 2009 - 2013

The State of Hawaii enjoys some of the best air quality in the nation. However, as in any metropolitan area, we still experience our share of air pollution. In order to maintain Hawaii's air quality, pollution sources are regulated through the promulgation of rules and the issuance of air permits which limits emissions. The ambient air is monitored throughout the State by analyzers and meteorological equipment installed at strategic locations.

Air pollution is generated by many different sources. "Stationary sources" include those of factories, power plants, and refineries. "Area sources" are smaller stationary sources from which emissions are not easily associated with a single piece of equipment or activity. "Mobile sources" include cars, buses, planes, trucks, and trains. "Natural sources" are events such as wildfires, windblown dust, and volcanic eruptions. To protect the air quality, the Clean Air Act was enacted to provide the principal framework for National, and State efforts against air pollution.

The Clean Air Act established the National Ambient Air Quality Standards (NAAQS). The NAAQS is a set of health-based limits below which no adverse impacts to humans or the environment are anticipated. Two levels of standards are set in the NAAQS. "Primary" standards are designed to establish limits to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. "Secondary" air quality standards set limits to protect public welfare, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings.

The U.S. Environmental Protection Agency (EPA) has set national air quality standards for six principal pollutants referred to as "criteria" pollutants. These are sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (O_3), lead (Pb) and particulate matter. This last pollutant includes particulate matter with an aerodynamic diameter less than or equal to ten microns (PM_{10}) and two and a-half microns ($PM_{2.5}$).

Two other pollutants, not covered by the NAAQS, are mentioned in this report. Volatile Organic Compounds (VOC) are a precursor of O_3, and, consequently, of smog. Total Suspended Particulates (TSP) was replaced as a criteria pollutant by PM_{10}. Performance standards exist for VOCs and TSP within the Hawaii Administrative Rules and both pollutants are controlled by permit.

Hawaii's air quality meets or exceeds all of the federal standards for air pollution control. As an example, the State's Ambient Air Quality Standards for CO and NO_2 are more stringent than the NAAQS.

The Department of Health currently operates and maintains a network of four State and Local Air Monitoring Stations (SLAMS) on the island of Oahu. Up until 2009, there were three stations operating in the CIP area: Kapolei, West Beach, and Makaiwa. However, the Makaiwa station was discontinued in July 2009 and the West Beach station was discontinued in 2011. Detailed descriptions of each monitoring station are provided below.

The ambient air quality trends are based on actual measurements of pollutant concentrations in the air. Air pollutant trends for the three stations during the most recent five years are graphically displayed while the tables summarize the highest concentrations and annual average concentrations.

None of the air pollutants measured exceeded the national or state ambient air quality standards. The 1-hour and 8-hour CO, and 3-hour SO_2 trends are based on the annual average of the daily maximum concentrations in each calendar year. Annual trends are based on the average of all valid hourly measurements recorded in the year. Except for PM_{10}, the air quality trends for SO_2, NO_2, and CO in the CIP area have been relatively level and well below the national and state standards. The PM_{10} values show greater variability but are still well below the standards.

Summary of Air Quality Data
2009 - 2013

DEFINITIONS

1. The “Maximum Concentration” is the highest value recorded in the year for the averaging period.

2. The “Average of the Daily Max. Conc.” is the annual arithmetic mean of all the daily maximum values recorded for the averaging period.

3. “98th percentile” for Nitrogen Dioxide (NO_2) and $PM_{2.5}$ is the 1-hour or 24-hour average, respectively, that is higher than 98 percent of all valid values recorded in the year. Similarly, the “99th percentile” for Sulfur Dioxide (SO_2) is the 1-hour average that is higher than 99 percent of all valid values recorded in the year. The percentile values are used to determine compliance with these standards. For Ozone (O_3), the value that determines compliance with the 8-hour standard is the 4th highest daily 8-hour value in the year. For Lead (Pb), compliance is the maximum rolling 3-month average of 24-hour values. Pb is sampled once every 6 days with a manual filter-based sampler.

4. “Possible Periods” is the total number of possible sampling periods in the year.

5. “Valid Periods” is the total number of valid sampling periods after data audits.

6. “Annual Average” is the arithmetic mean of all hours recorded in the year.

STATIONS

Kapolei

This station is located at 2052 Lauwiliwili Street approximately 200 yards south of the Desalination facility and the Kapolei Fire Station.

The pollutants sampled at this station are carbon monoxide (CO), NO_2, SO_2, PM_{10}, and $PM_{2.5}$. O_3 monitoring began on January 1, 2011. Pb monitoring began January 1, 2012. Meteorological parameters measured are wind speed, wind direction and ambient temperature.

West Beach

This station was located within the Ko’Olina Golf Course, west of Campbell Industrial park. Established in February 1991, the pollutants measured were NO_2, SO_2, and PM_{10}.

This station was shut-down on March 31, 2011, with EPA approval, due to low value data, close proximity to the Kapolei monitoring station, and budget constraints. Notification of the station closure was provided in the 2011 Network Plan which was available for public comment from May 17 to June 17, 2011. No comments were received.

Makaiwa

Established July 1989 to monitor for SO_2, this station was located at 92-670 Farrington Highway, across from the Honokai Hale subdivision. With EPA approval, the station was discontinued July 1, 2009 due to historically low data values and the need to redistribute resources to meet new monitoring requirements.

2009 Pollutant	Kapolei	West Beach	Makaiwa [1]
1-hour Carbon Monoxide (ppm)			
Maximum Concentration	3.7		
Average of Daily Max. Conc.	0.39		
Possible Periods	8760		
Valid Periods	7931		
State/Federal Standard	9 / 35		
8-hour Carbon Monoxide (ppm)			
Maximum Concentration	1.2		
Average of Daily Max. Conc.	0.31		
Possible Periods	8755		
Valid Periods	8044		
State/Federal Standard	4.4 / 9		
3-hour Sulfur Dioxide (ppm)			
Maximum Concentration	0.010	0.009	0.015
Average of Daily Max. Conc.	0.0016	0.0017	0.0028
Possible Periods	2920	2920	1448
Valid Periods	2544	2394	1395
State and Federal Standard	0.500	0.500	0.500
24-hour Sulfur Dioxide (ppm)			
Maximum Concentration	0.003	0.004	0.005
Possible Periods	365	365	181
Valid Periods	359	345	180
State and Federal Standard	0.140	0.140	0.140
Ann. Ave. Sulfur Dioxide (ppm)			
Annual Average	0.0009	0.0008	0.0015
Possible Periods	8760	8760	4344
Valid Periods	8080	7997	4277
State and Federal Standard	0.030	0.030	0.030
Ann. Ave. Nitrogen Dioxide (ppm)			
Annual Average	0.004	0.003	
Possible Periods	8760	8760	
Valid Periods	8062	7665	
State / Federal Standard	0.040 / 0.053	0.040 / 0.053	
24-hour PM_{10} ($\mu g/m^3$)			
Maximum Concentration	37	134 [2]	
Possible Periods	365	365	
Valid Periods	352	356	
State and Federal Standard	150	150	
Ann. Ave. PM_{10} ($\mu g/m^3$)			
Annual Average	16	16	
Possible Periods	365	365	
Valid Periods	352	356	
State Standard	50	50	
24-hour $PM_{2.5}$ ($\mu g/m^3$)			
Maximum Concentration	25		
98^{th} Percentile	12.5		
Possible Periods	365		
Valid Period	358		
Federal Standard	35		
Ann. Ave. $PM_{2.5}$ ($\mu g/m^3$)			
Annual Average	6		
Possible Periods	365		
Valid Periods	358		
Federal Standard	15		

[1] Makaiwa was shut-down on June 30, 2009, data year is incomplete.
[2] High value attributed to construction vehicles traveling on the dirt road next to the station

2010 **Pollutant**	**Kapolei**	**West Beach**
1-hour Carbon Monoxide (ppm)		
Maximum Concentration	1.6	
Average of Daily Max. Conc.	0.3	
Valid Periods / Possible Periods	7956 / 8760	
State/Federal Standard	9 / 35	
8-hour Carbon Monoxide (ppm)		
Maximum Concentration	1.0	
Average of Daily Max. Conc.	0.2	
Valid Periods / Possible Periods	8344 / 8755	
State/Federal Standard	4.4 / 9	
1-hour Sulfur Dioxide (ppb) [1]		
Maximum Concentration	21	29
99^{th} Percentile Value	18	20
Valid Periods / Possible Periods	7932 / 8760	8114 / 8760
Federal Standard	75	75
3-hour Sulfur Dioxide (ppm)		
Maximum Concentration	0.012	0.009
Average of Daily Max. Conc.	0.002	0.002
Valid Periods / Possible Periods	2447 / 2920	2506 / 2920
State and Federal Standard	0.500	0.500
24-hour Sulfur Dioxide (ppm)		
Maximum Concentration	0.004	0.003
Valid Periods / Possible Periods	352 / 365	361 / 365
State and Federal Standard	0.140	0.140
Ann. Ave. Sulfur Dioxide (ppm)		
Annual Average	0.001	0.001
Valid Periods / Possible Periods	7932 / 8760	8143 / 8760
State and Federal Standard	0.030	0.030
1-hour Nitrogen Dioxide (ppb) [2]		
Maximum Concentration	33	23
98^{th} Percentile Value	24	20
Valid Periods / Possible Periods	7773 / 8760	8143 / 8760
Federal Standard	100	100
Ann. Ave. Nitrogen Dioxide (ppm)		
Annual Average	0.003	0.002
Valid Periods / Possible Periods	7773 / 8760	8114 / 8760
State / Federal Standard	0.040 / 0.053	0.040 / 0.053
24-hour PM_{10} ($\mu g/m^3$)		
Maximum Concentration	59	92
Valid Periods / Possible Periods	349 / 365	360 / 365
State and Federal Standard	150	150
Ann. Ave. PM_{10} ($\mu g/m^3$)		
Annual Average	15.5	13.9
Valid periods / Possible Periods	349 / 365	360 / 365
State Standard	50	50
24-hour $PM_{2.5}$ ($\mu g/m^3$)		
Maximum Concentration	61.0 [3] / 23.8	
98^{th} Percentile Value	11.8	
Valid Periods / Possible Periods	357 / 365	
Federal Standard	35	
Ann. Ave. $PM_{2.5}$ ($\mu g/m^3$)		
Annual Average	4.3	
Valid Periods / Possible Periods	357 / 365	
Federal Standard	15	

[1] 1-hour federal sulfur dioxide standard promulgated June 2, 2010.
[2] 1-hour federal nitrogen dioxide standard promulgated January 22, 2010
[3] The maximum and 2^{nd} highest values were attributed to the New Year's fireworks celebration. 23.8 $\mu g/m^3$ is the 3^{rd} highest value and is not attributed to an exceptional event.

2011 Pollutant	Kapolei	West Beach [1]
1-hour Carbon Monoxide (ppm)		
Maximum Concentration	1.2	
Average of Daily Max. Conc.	0.7	
Valid Periods / Possible Periods	8501 / 8760	
State/Federal Standard	9 / 35	
8-hour Carbon Monoxide (ppm)		
Maximum Concentration	1.0	
Average of Daily Max. Conc.	0.6	
Valid Periods / Possible Periods	8610 / 8755	
State/Federal Standard	4.4 / 9	
1-hour Sulfur Dioxide (ppb)		
Maximum Concentration	19	18
99th Percentile Value	6	18
Valid Periods / Possible Periods	8497 / 8760	1758 / 2160
Federal Standard	75	75
3-hour Sulfur Dioxide (ppm)		
Maximum Concentration	0.013	0.013
Average of Daily Max. Conc.	0.002	0.003
Valid Periods / Possible Periods	2723 / 2920	546 / 720
State and Federal Standard	0.500	0.500
24-hour Sulfur Dioxide (ppm)		
Maximum Concentration	0.003	0.003
Valid Periods / Possible Periods	359 / 365	73 / 90
State and Federal Standard	0.140	0.140
Ann. Ave. Sulfur Dioxide (ppm)		
Annual Average	0.002	0.002
Valid Periods / Possible Periods	8497 / 8760	1725 / 2160
State and Federal Standard	0.030	0.030
1-hour Nitrogen Dioxide (ppb)		
Maximum Concentration	25	23
98th Percentile Value	22	23
Valid Periods / Possible Periods	8476 / 8760	1725 / 2160
Federal Standard	100	100
Ann. Ave. Nitrogen Dioxide (ppm)		
Annual Average	0.003	0.002
Valid Periods / Possible Periods	8476 / 8760	1725 / 2160
State / Federal Standard	0.040 / 0.053	0.040 / 0.053
8-hour O_3 (ppm)[2]		
Maximum Concentration	0.056	
4th Highest Daily Value	0.050	
Valid Periods/Possible Periods	6783/8755	
Federal Standard	0.075	
24-hour PM_{10} (µg/m^3)		
Maximum Concentration	51	49
Valid Periods / Possible Periods	343 / 365	85 / 90
State and Federal Standard	150	150
Ann. Ave. PM_{10} (µg/m^3)		
Annual Average	16	19
Valid periods / Possible Periods	343 / 365	85 / 90
State Standard	50	50
24-hour $PM_{2.5}$ (µg/m^3)		
Maximum Concentration	21.2	
98th Percentile Value	12.6	
Valid Periods / Possible Periods	336 / 365	
Federal Standard	35	
Ann. Ave. $PM_{2.5}$ (µg/m^3)		
Annual Average	5.3	
Valid Periods / Possible Periods	336 / 365	
Federal Standard	15	

[1] West Beach was shut-down on March 31, 2011, data year is incomplete.

[2] Monitoring for O_3 began at the Kapolei station on January 1, 2011

2012 Pollutant	Kapolei
1-hour Carbon Monoxide (ppm)	
Maximum Concentration	1.5
Average of Daily Max. Conc.	0.75
Valid Periods / Possible Periods	8613 / 8784
State/Federal Standard	9 / 35
8-hour Carbon Monoxide (ppm)	
Maximum Concentration	1.1
Average of Daily Max. Conc.	0.69
Valid Periods / Possible Periods	8709 / 8779
State/Federal Standard	4.4 / 9
1-hour Sulfur Dioxide (ppb)	
Maximum Concentration	12
99^{th} Percentile Value	7
Valid Periods / Possible Periods	8388 / 8784
Federal Standard	75
3-hour Sulfur Dioxide (ppm)	
Maximum Concentration	0.007
Average of Daily Max. Conc.	0.002
Valid Periods / Possible Periods	2704 / 2928
State and Federal Standard	0.500
24-hour Sulfur Dioxide (ppm)	
Maximum Concentration	0.004
Valid Periods / Possible Periods	354 / 366
State and Federal Standard	0.140
Ann. Ave. Sulfur Dioxide (ppm)	
Annual Average	0.002
Valid Periods / Possible Periods	8388 / 8784
State Federal Standard	0.030
1-hour Nitrogen Dioxide (ppb)	
Maximum Concentration	27
98^{th} Percentile Value	19
Valid Periods / Possible Periods	8190 / 8784
Federal Standard	100
Ann. Ave. Nitrogen Dioxide (ppm)	
Annual Average	0.003
Valid Periods / Possible Periods	8190 / 8784
State / Federal Standard	0.040 / 0.053
8-hour O_3 (ppm)	
Maximum Concentration	0.049
4^{th} Highest Daily Value	0.046
Valid Periods/Possible Periods	8356 / 8779
Federal Standard	0.075
24-hour PM_{10} ($\mu g/m^3$)	
Maximum Concentration	40
Valid Periods / Possible Periods	352 / 366
State and Federal Standard	150
Ann. Ave. PM_{10} ($\mu g/m^3$)	
Annual Average	16
Valid periods / Possible Periods	352 / 366
State Standard	50
24-hour $PM_{2.5}$ ($\mu g/m^3$)	
Maximum Concentration	23.5
98^{th} Percentile Value	14.8
Valid Periods / Possible Periods	355 / 366
Federal Standard	35
Ann. Ave. $PM_{2.5}$ ($\mu g/m^3$)	
Annual Average	7.1
Valid Periods / Possible Periods	355 / 366
Federal Standard	15
3-month Pb ($\mu g/m^3$)	
Maximum 3-month average	0.0014
Valid Periods/Possible Periods	10/10
Federal Standard	0.15

2013 Pollutant	Kapolei
1-hour Carbon Monoxide (ppm)	
Maximum Concentration	1.3
Average of Daily Max. Conc.	0.75
Valid Periods / Possible Periods	8389 / 8760
State/Federal Standard	9 / 35
8-hour Carbon Monoxide (ppm)	
Maximum Concentration	1.0
Average of Daily Max. Conc.	0.70
Valid Periods / Possible Periods	8449 / 8755
State/Federal Standard	4.4 / 9
1-hour Sulfur Dioxide (ppb)	
Maximum Concentration	16
99th Percentile Value	9
Valid Periods / Possible Periods	8364 / 8760
Federal Standard	75
3-hour Sulfur Dioxide (ppm)	
Maximum Concentration	0.011
Average of Daily Max. Conc.	0.002
Valid Periods / Possible Periods	2674 / 2920
State and Federal Standard	0.500
24-hour Sulfur Dioxide (ppm)	
Maximum Concentration	0.005
Valid Periods / Possible Periods	355 / 365
State and Federal Standard	0.140
Ann. Ave. Sulfur Dioxide (ppm)	
Annual Average	0.002
Valid Periods / Possible Periods	8364 / 8760
State Federal Standard	0.030
1-hour Nitrogen Dioxide (ppb)	
Maximum Concentration	31
98th Percentile Value	23
Valid Periods / Possible Periods	8074 / 8760
Federal Standard	100
Ann. Ave. Nitrogen Dioxide (ppm)	
Annual Average	0.003
Valid Periods / Possible Periods	8074 / 8760
State / Federal Standard	0.040 / 0.053
8-hour O_3 (ppm)[2]	
Maximum Concentration	0.057
4th Highest Daily Value	0.051
Valid Periods/Possible Periods	4747/8755
Federal Standard	0.075
24-hour PM_{10} ($\mu g/m^3$)	
Maximum Concentration	39
Valid Periods / Possible Periods	359 / 365
State and Federal Standard	150
Ann. Ave. PM_{10} ($\mu g/m^3$)	
Annual Average	15
Valid periods / Possible Periods	359 / 365
State Standard	50
24-hour $PM_{2.5}$ ($\mu g/m^3$)	
Maximum Concentration	16.2
98th Percentile Value	12.0
Valid Periods / Possible Periods	347 / 365
Federal Standard	35
Ann. Ave. $PM_{2.5}$ ($\mu g/m^3$)	
Annual Average	2.8
Valid Periods / Possible Periods	347 / 365
Federal Standard [1]	12
3-month Pb ($\mu g/m^3$)	
Maximum 3-month average	0.0016
Valid Periods/Possible Periods	10/10
Federal Standard	0.15

[1] New annual standard eff. December 14, 2012

Figure 1. Annual Average of Maximum 1-hour Carbon Monoxide: 2009 - 2013

(Annual average of the daily maximum 1-hour values)

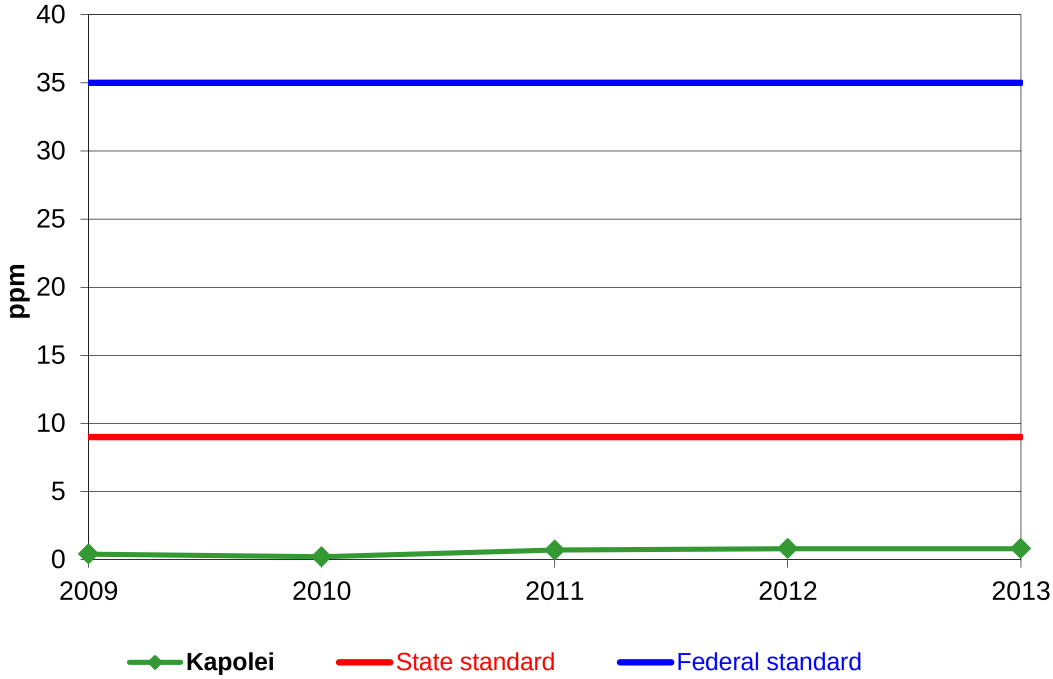


Figure 2. Annual Average of Maximum 8-hour Carbon Monoxide: 2009 - 2013

(Annual average of the daily maximum 8-hour values)

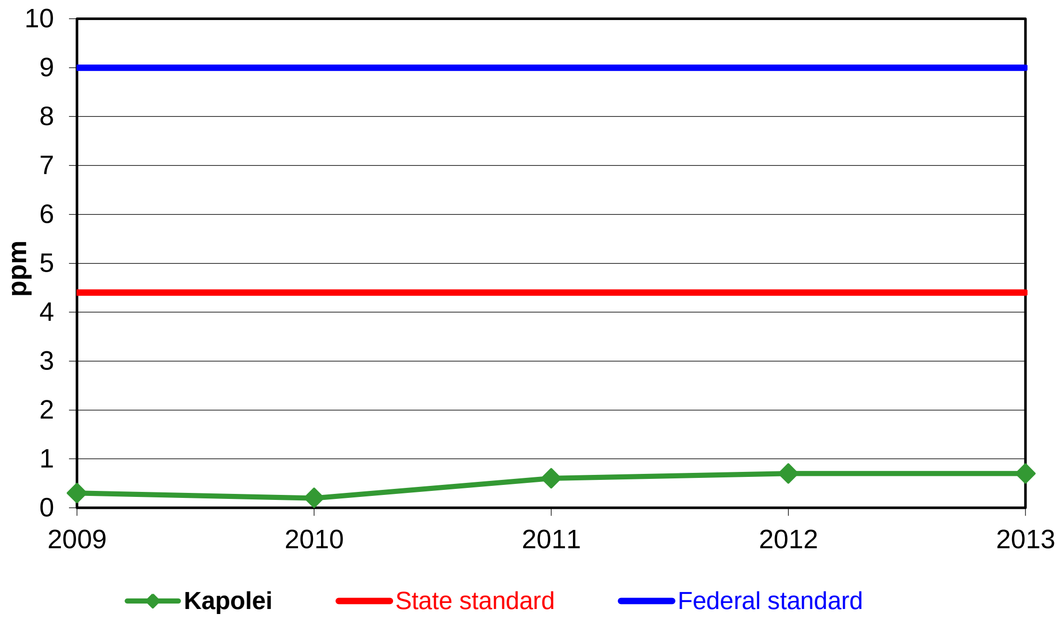


Figure 3. Annual Average of Maximum 3-Hour SO_2
2009 - 2013
(Annual average of the maximum 3-hour values)

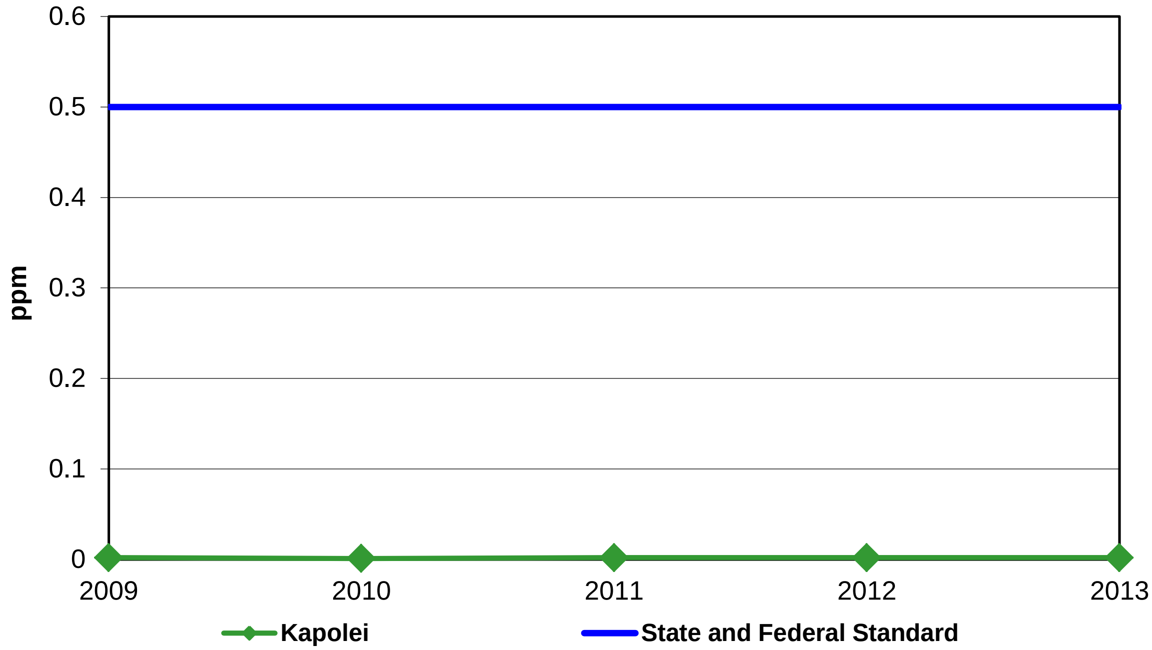


Figure 4. Maximum 24-hour Sulfur Dioxide
2009 - 2013
(The highest 24-hour value in the year)

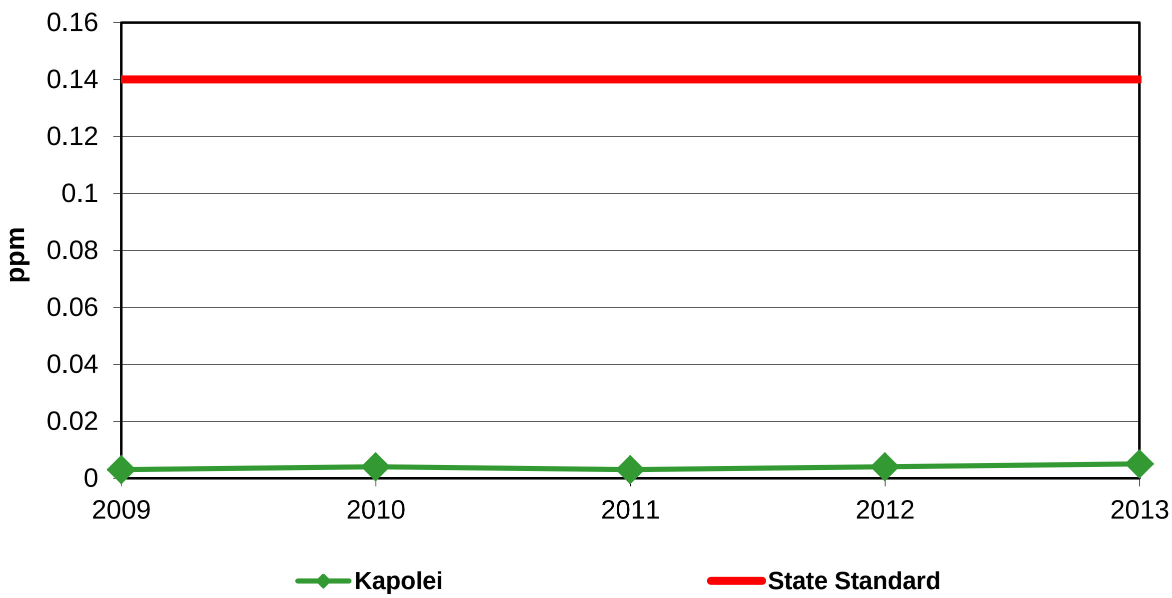


Figure 5. Annual Average of Sulfur Dioxide 2009 - 2013

(Average of all valid hours in the year)

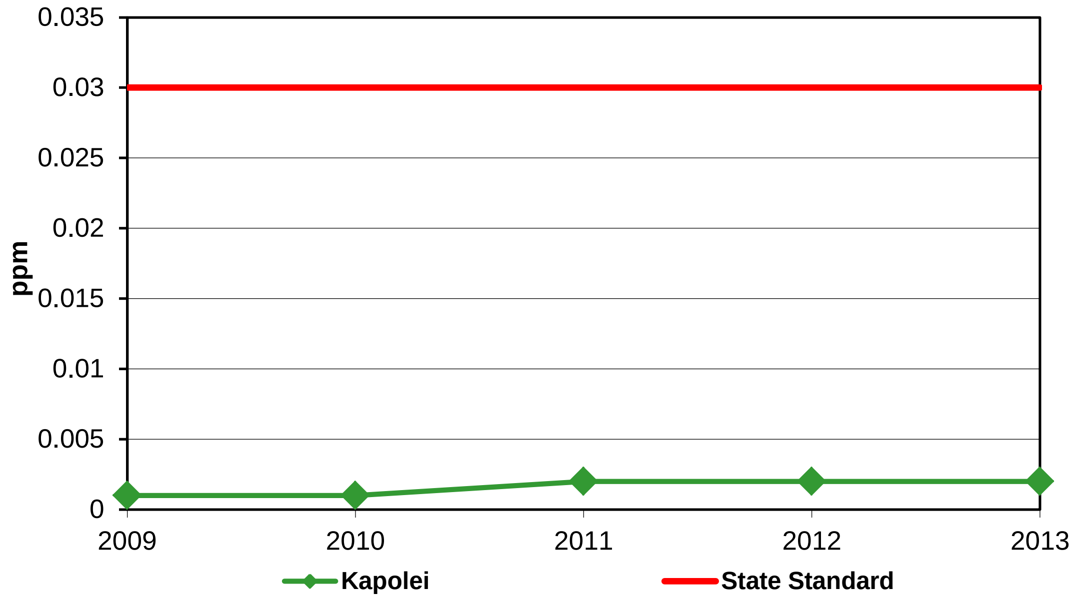


Figure 6. 99th Percentile 1-Hour Sulfur Dioxide 2009 - 2013

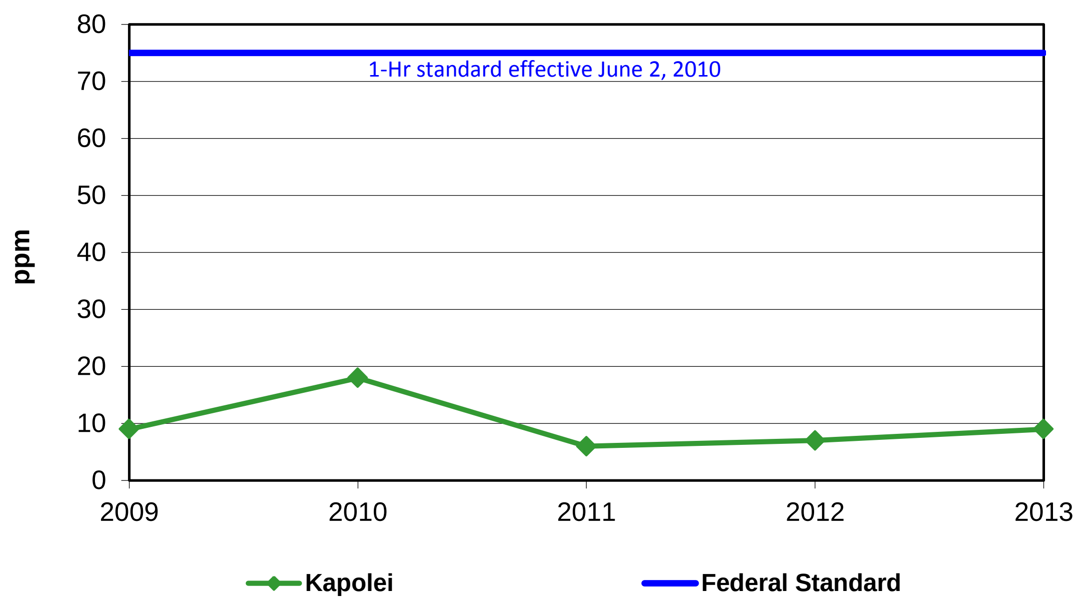


Figure 7. Annual Average of Nitrogen Dioxide 2009 - 2013

(Average of all valid hours in the year)

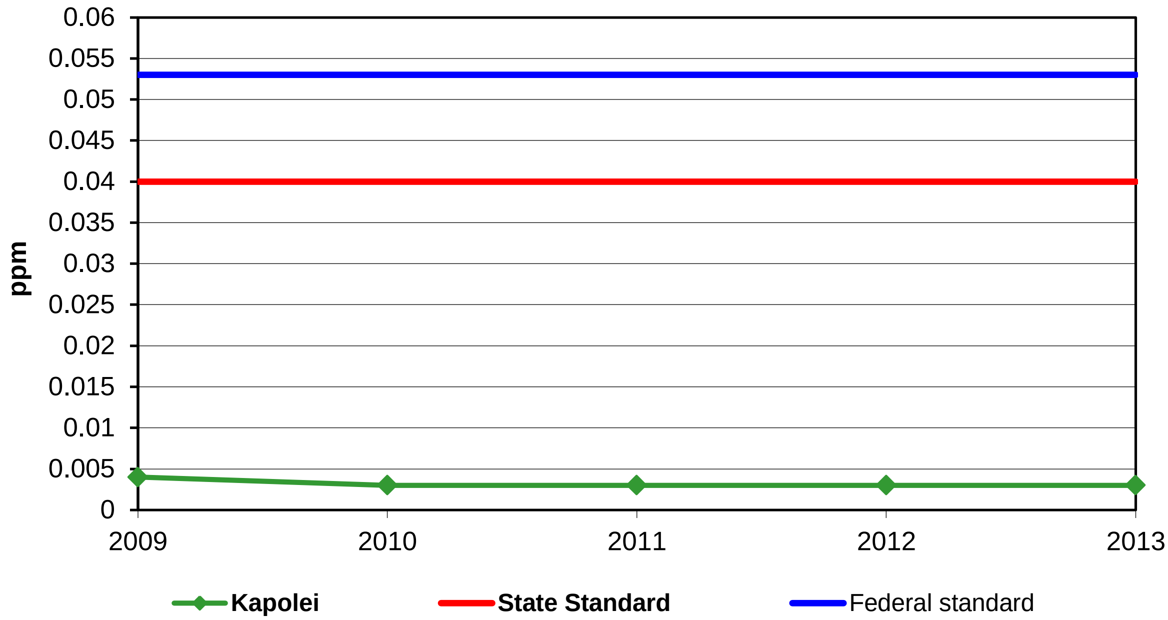


Figure 8. 98th Percentile 1-Hour Nitrogen Dioxide 2009 - 2013

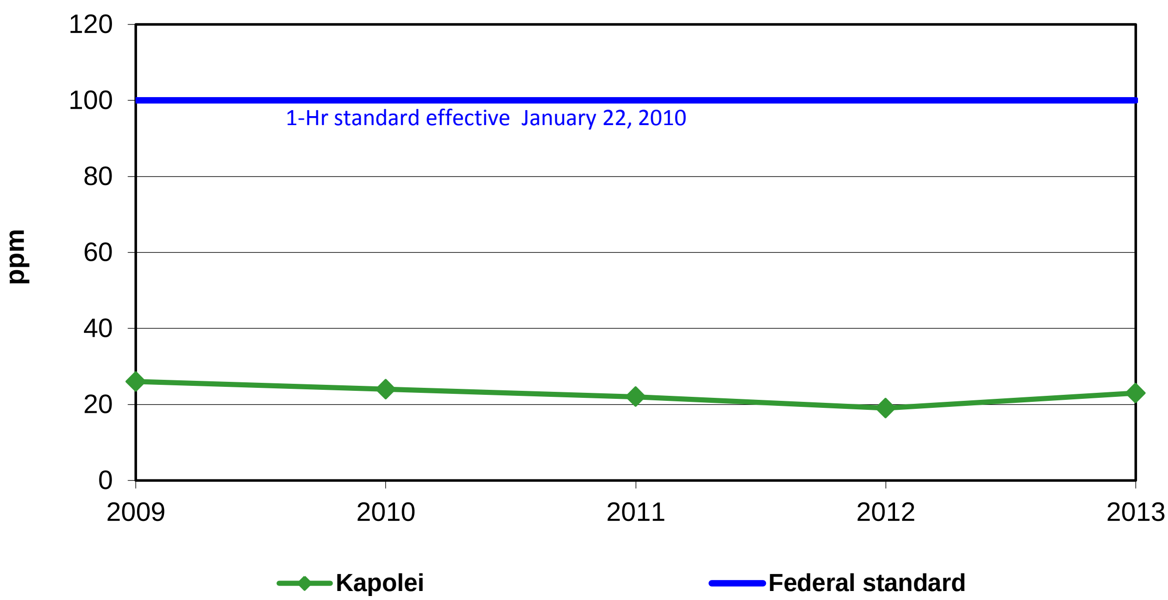


Figure 9. Maximum 24-hour PM_{10} : 2009 - 2013

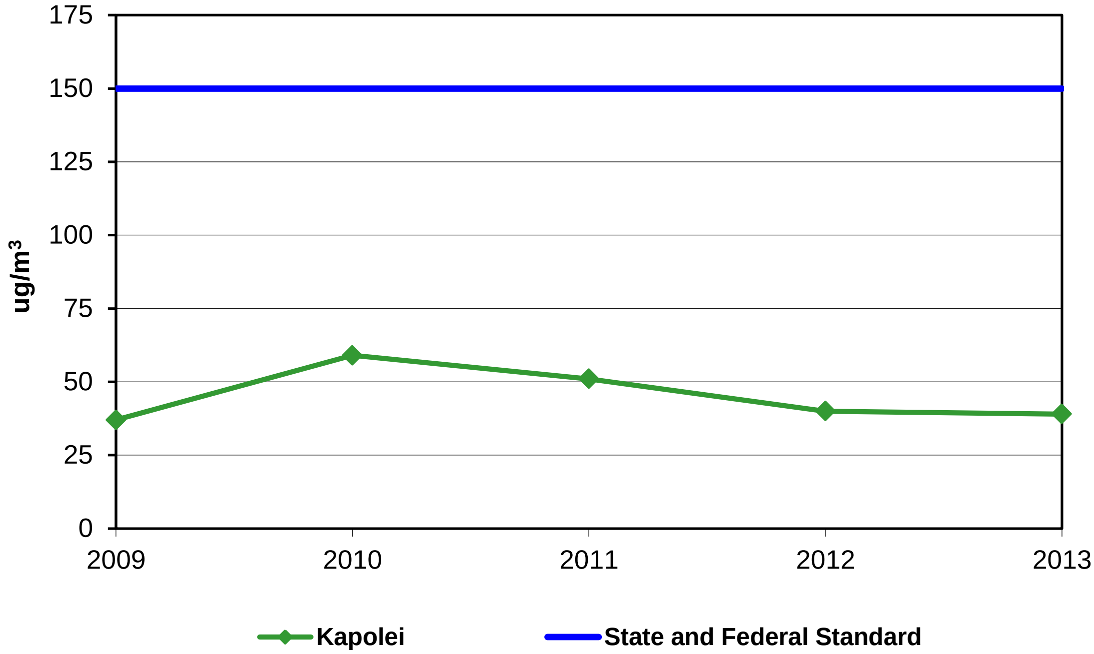


Figure 10. Annual Average of PM_{10}: 2009 - 2013

(Average of all valid 24-hour values in the year)

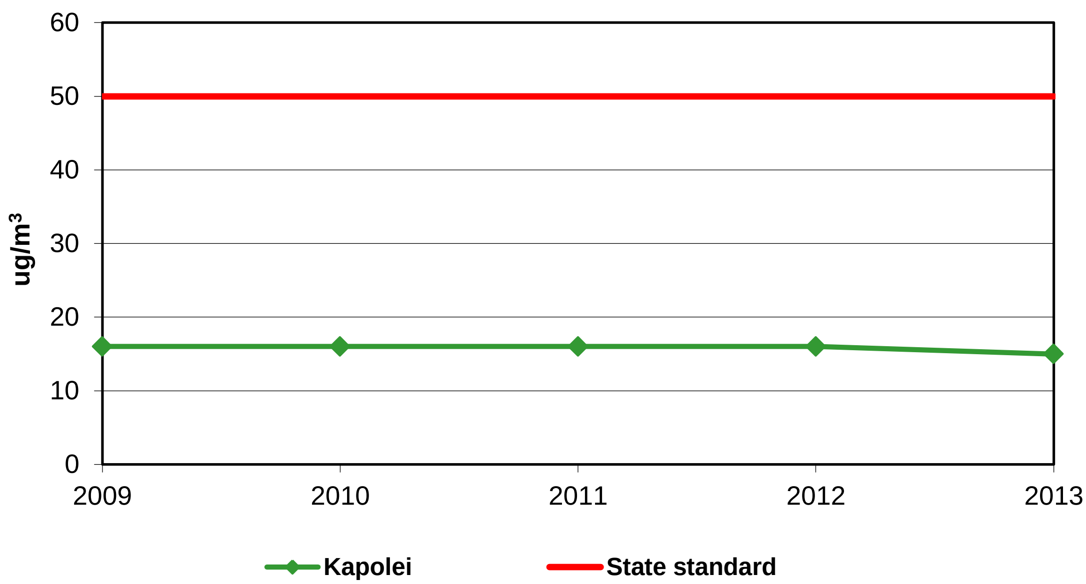


Figure 11. 98th Percentile 24-hour $PM_{2.5}$ 2009 - 2013

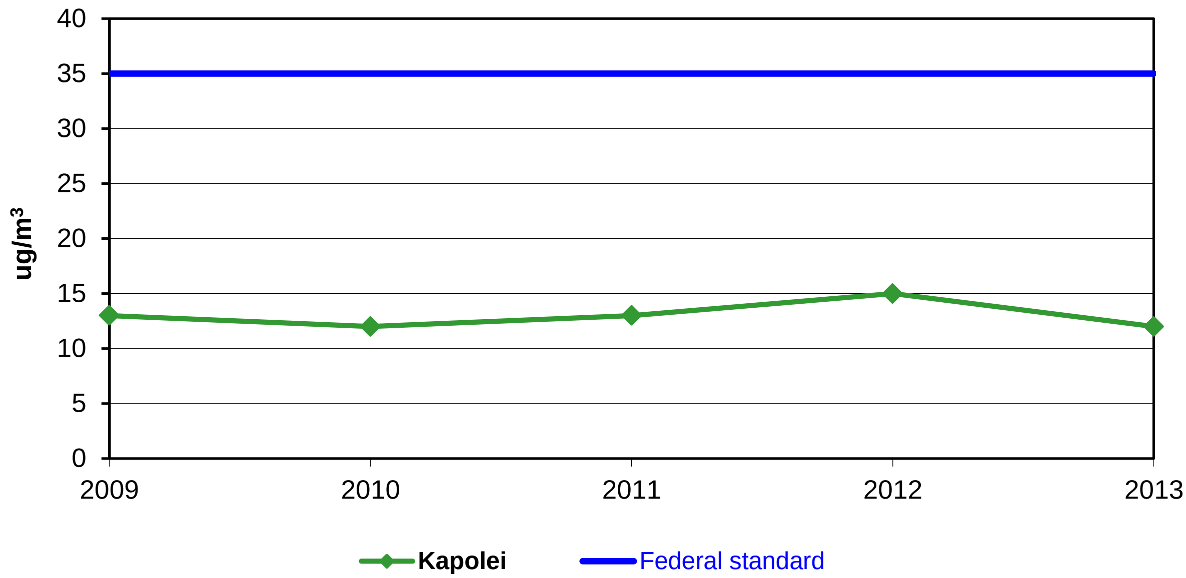
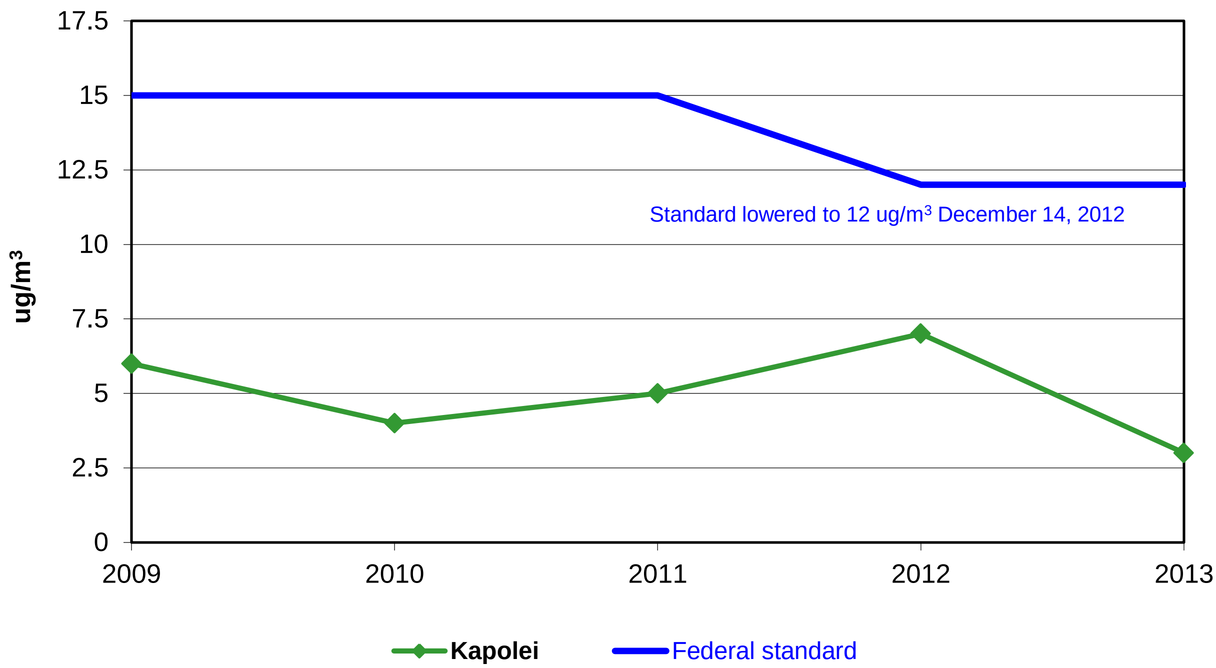


Figure 12. Annual Average of $PM_{2.5}$: 2009 - 2013

(Average of all valid 24-hour values in the year)



SECTION 3.
Measurements of Selected Criteria Pollutants in the Campbell Industrial Park Area and the Health Effects Expected at These Levels of Exposure

HEER Office, November, 2014

Criteria Pollutants

The United States government through the Environmental Protection Agency (EPA) Office of Air Quality Planning and Standards has established National Ambient Air Quality Standards (NAAQS) for six “criteria air pollutants” considered harmful to public health and the environment. These standards are based on epidemiological studies and controlled laboratory experiments. The six Criteria Air Pollutants include: ozone (O_3); airborne lead (Pb); particulate matter, including both PM_{10} and $PM_{2.5}$; carbon monoxide (CO); nitrogen dioxide (NO_2); and sulfur dioxide (SO_2). These pollutants were selected based on multiple criteria including their toxicity and their relative abundance and distribution in industrialized society.

The Clean Air Branch in the Department of Health has collected data for CO, NO_2,SO_2, PM_{10}, $PM_{2.5}$ and lead at the Kapolei Station in Campbell Industrial Park (CIP). These data are summarized for the years 2008 -2013 in Section 2 of this report.

The levels of these criteria air pollutants measured in the CIP area are consistently below the National Ambient Air Quality Standards and Hawaii State Ambient Air Quality Standards.

Possible Health Effects of Criteria Air Pollutants at CIP

The following is an overview of some of the possible health effects of the four criteria air pollutants measured at CIP. This is *not* intended to be a complete or thorough description of the toxicology of these pollutants. Rather, this note aims to give some idea of the effects these pollutants can have *at high enough concentrations*. First, it is important to understand the first rule of toxicology: that taking a sufficient amount of *<u>any</u>* material into the body can produce toxic effects. The rate of intake can also influence toxic effects. Humans, on average over a day or more, typically breathe about 20 cubic meters of air per day. Because of this and available scientific data, we can get a fairly good idea of what concentrations of air pollutants are needed before adverse health effects are seen. Even so, there are no clear cut numbers below which, there is no risk and above which we are all at risk. Safety factors are then used to help compensate for uncertainties and to provide added protection for the more sensitive people in the population.

In the following paragraphs, the levels of pollutants measured in the CIP area in 2013 are compared to the NAAQS and the expected health effects for those levels of exposure are discussed as well as the effects that would be expected at much higher levels of exposure.

SO_2 SO_2 is a colorless gas and is often described as the "smell of burning sulfur". Man-made emissions of SO_2 are largely from sources that burn fossil fuels, coal, and oil. Stationary sources such as coal- and oil-fired power plants, steel mills, and refineries are the largest sources.

Volcanoes can be a significant natural source of sulfur dioxide. Sulfur dioxide is of major concern on the Island of Hawaii because the Kilauea volcano releases large quantities of sulfur dioxide into the environment that can directly impact people living nearby. In fact, in 2008 an increase in emissions at Halemaʻumaʻu crater at the Kilauea summit created potential health hazards for people with respiratory conditions living near the volcano. In response to the increased emissions, DOH developed a color coded short term SO_2 advisory for the Island of Hawaii (http://www.hiso2index.info/). SO_2 concentrations in communities downwind of Halemaʻumaʻu crater routinely exceed the SO_2 NAAQS.

The EPA considers that there is substantial evidence from human clinical and epidemiological studies that people with asthma are more susceptible to the respiratory health effects of SO_2 compared to the general population. Based upon a large body of evidence that brief exposures (5-10 minutes) to SO_2 can negatively affect the respiratory health of asthmatics, in June 2010, the EPA established a new 1-hour NAAQS for SO_2 of 0.075 ppm. The new standard is designed to protect against short-term exposures that result in adverse respiratory effects in people with asthma. The EPA considers that the new 1-hour standard appropriately protects public health with an adequate margin of safety.

In 2013, the maximum 1-hour concentration was 0.016 ppm, well below the NAAQS of 0.075 ppm. The maximum 3-hour concentration of 0.011 ppm was well below the Federal and State secondary standard of 0.50 ppm. Secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings.

NO_2: In January 2010, EPA released a new NAAQS for NO_2. The new one-hour standard of 0.100 ppm was established to protect public health from peak short-term exposures. The annual NAAQS level for nitrogen dioxide is 0.053 ppm for a one year averaging period, and Hawaii has set that level at 0.040 ppm for added safety. The annual average concentration measured in 2013 was 0.003 ppm, well below the Federal and State standard. The maximum 1-hour nitrogen dioxide concentration was 0.031 ppm, below the Federal standard of 0.100 ppm. SO_2 and NO_2 are gases that, combined with water on the wet surfaces of the body, produce acids. *At high enough levels*, these acid gases are irritating to the lungs, eyes, nose and throat, and can cause shortness of breath. The levels measured in the CIP area are below State and Federal standards and are not expected to produce adverse health effects. For irritants such as the acid gases SO_2 and NO_2, sensitive individuals may have short-lived responses to brief peaks in concentration which would not appear in these averaged data. Such short-term peaks are more apparent in the maximum readings found in shorter term (1-3 hour) averaging times.

CO: The NAAQS levels for carbon monoxide have been set at 35 ppm for a 1-hour averaging period, and 9 ppm for an 8-hour averaging period. Hawaii has set those levels at 9 and 4.4 ppm respectively for added safety. In 2013, the 1-hour average was 0.75 ppm and the 8-hour average was 0.70 ppm. These average levels of exposure are not expected to produce adverse health effects. In 2013, the maximum 1-hour concentration for carbon monoxide was 1.3 ppm. The maximum 8-hour concentration for carbon monoxide was 1.0 ppm.

CO is an odorless colorless gas that interferes with the ability of blood to carry oxygen. Symptoms of overexposure include headache, shortness of breath, dizziness at about 50-100+ ppm; severe headache, weakness, dizziness, nausea / vomiting fainting, rapid breathing at 400-500+ ppm; fainting, seizure, coma, respiratory failure, death at 1000-4000+ ppm. The highest one hour average level measured in the CIP area was 1.3 ppm.

Lead: The maximum 3 month average lead level was 0.0016 ug/m^3 ,well below the Federal standard of 0.15 ug/m^3.

Particulate Matter PM_{10} and $PM_{2.5}$: The NAAQS level for PM_{10} has been set at 150 $\mu g/m^3$ averaged over 24 hours. Hawaii also has a standard of 50 ug/m^3 averaged over one year. In response to new scientific data, EPA revised the particulate matter standard in July, 1997 to include a standard for “fine particles” which are equal to or less than 2.5 micrometers in size ($PM_{2.5}$). These $PM_{2.5}$ standards were set at 65 $\mu g/m^3$ averaged over 24 hours and 15 $\mu g/m^3$ averaged over one year. On December 17, 2006 the 24-hour standard for $PM_{2.5}$ was lowered to 35 $\mu g/m^3$ to better protect the public from short-term fine particle exposure. On Dec. 14, 2012 the EPA strengthened the nation’s air quality standard for fine particle pollution by revising the annual $PM_{2.5}$ standard to 12 $\mu g/m^3$.

Adverse health effects of particulate matter can include impaired lung function, a reduction in capacity for physical activity, complication of heart disease and increased population death rates. The levels of exposure producing adverse effects are even less clear cut than they are for the gases discussed above. Based on laboratory results and extensive epidemiology studies, the EPA has set the fine particulate standards to provide an increased measure of protection from adverse health effects due to particulate matter.

The annual average for PM_{10} was 15.0 $\mu g/m^3$.The maximum 24-hour concentration was 39 $\mu g/m^3$. Although the adverse health effects from these levels of exposure are currently controversial, these averages are similar to

Honolulu which has one of the lowest urban PM_{10} levels in the United States. For $PM_{2.5}$, the maximum 24-hour concentration was 16.2 μg/m^3 and the annual average was 2.8 μg/m^3, below Federal standards.